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A dairy recordkeeping plan for every herd

ANIMAL SCIENCE RESEARCH DIVISION

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DISTRIBUTION OF ACTIVE ARTIFICIAL INSEMINATION (AI) SIRES SUMMARIZED IN THE USDA-DHIA SIRE SUMMARY BY LEVEL OF PREDICTED DIFFERENCE FOR MILK AND FAT PRODUCTION OF DAUGHTERS

by G. J. King, F. N. Dickinson, B. T. McDaniel, and H. D. Norman

The average production of daughters and daughters' herdmates of all active AI sires, summarized in the January 1972 USDA-DHIA Sire Summary List, were categorized by breed of sire and grouped in table 1 according to the range of the sire's Predicted Difference (PD) for milk and in table 2 according to the range of the sires' PD for fat.

The line set off by dashes at the bottom of each breed group includes averages derived by weighting by the number of daughters of each sire.

The average PD's for milk by breeds for two years were as follows:

Breed	Jan. 1971	Jan. 1972
	Lb.	Lb.
Ayrshire	271	260
Guernsey	214	200
Holstein	245	298
Jersey	178	193
Brown Swiss	229	279
Milking Shorthorn	83	6
Average	233	273

Similar figures for fat were:

Breed	Jan. 1971	Jan. 1972
	Lb.	Lb.
Ayrshire	7	8
Guernsey	9	7
Holstein	8	8
Jersey	9	9
Brown Swiss	7	8
Milking Shorthorn	3	1
Average	8	8

The average milk PD of 273 for 1972 vs. 233 for 1971 indicates that PD's have increased.

Table 1 shows that the number of bulls in each breed with PD's for milk of +400 pounds or higher were as follows: 6 of 20 Ayrshires, 22 of 86 Guernseys, 247 of 599 Holsteins, 17 of 84 Jerseys, 16 of 30 Brown Swiss, and 1 of 8 Milking Shorthorns. The data also indicates that with the exception of one group, the bulls with average milk PD's above zero have average fat PD's above zero.

Interpretation of Data

A zero Predicted Difference in the tables indicates that a sire with zero PD, used in breed average herds, has about half of his daughters above and about half below breed average. He can be expected to transmit somewhat less than breed-average production to his future progeny because of genetic improvement across years. In general, the bulls with minus PD's sire daughters more than 50 percent of which are below breed average in production. The bulls with higher PD's are expected to sire daughters with higher production than bulls with lower PD's regardless of herd production level.

What These Data Mean to a Dairyman

Dairymen who derive most of their income from the sale of milk should, of course, be using sires with high plus

Predicted Differences. These tables indicate that the availability of AI sires with plus PD's is sufficient in all breeds to fulfill the requirements of the industry for a pool of germ plasm that will assure a steady increase in production in future generations. The distribution of PD's shown in table 1 indicate that a great deal more selection for increased production could be practiced. For instance, 25.9 percent of sires in all breeds have PD's for milk below zero. If these sires are used in breed average herds, the probability that they will transmit at least breed average milk production to their daughters is less than 50 percent. 1/ The use of bulls with minus or zero PD's should be avoided. Dairymen should be aware that if they use such bulls to breed cows in the same environment, most can expect to have lower herd averages in the future. The tables show also that for all breeds except Holstein, the PD's weighted by number of daughters are lower than the unweighted PD's. This indicates selection for traits other than yield, thus lessening opportunity for increasing yield and income.

On the other hand, 37 percent of the bulls have PD's for milk production of 400 pounds or above. Assuming a repeatability of 65 percent, the probability that such a bull will transmit above breed average production to his daughters is at least 90 percent (9 to 1 odds). 1/ Thus, these bulls will raise milk production in most herds.

A minimum of three sires in each breed except Milking Shorthorn has a PD for milk of 600 pounds or above. In the five breeds, summarized, 189 such sires were available in AI during 1971. This number would be enough to breed nearly all of the approximately 50 percent of dairy cows presently being bred to AI bulls in the nation each year. According to USDA procedure for calculating PD for income (January 1971 Dairy Herd Improvement Letter, ARS 44-223), it can be shown that these bulls produce milk valued at $43 higher than the milk expected from their breed average herdmates.

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1/ April 1968 Dairy Herd Improvement Letter, ARS 44-202 p. 24.

TABLE 1.--Average production of milk and butterfat of daughters of sires in AI service, grouped according to range of Predicted Difference for milk

Pred. Diff. milk range	Sires	Sires in group	Daughters w/HM	Daughter records	Average Production						Pred. Diff.	
					Daughters			Herdmates				
					Milk	Fat	Fat	Milk	Fat	Fat	Milk	Fat
Lb.	No.	%	No.	No.	Lb.	%	Lb.	Lb.	%	Lb.	Lb.	Lb.
AYRSHIRE												
1,000 & Up	1	5.0	32	51	12,819	3.8	482	10,844	3.9	418	1,114	36
800 to 999	1	5.0	20	31	15,604	4.0	622	12,578	4.1	512	939	35
600 to 799	1	5.0	31	31	13,631	3.6	495	12,473	3.9	485	744	8
400 to 599	3	15.0	733	1,282	12,676	3.9	491	12,147	3.9	471	462	16
200 to 399	4	20.0	576	1,157	12,756	3.9	495	12,355	3.9	487	267	8
0 to 199	7	35.0	1,353	2,603	12,011	3.9	469	11,970	3.9	467	63	4
-199 to -1	2	10.0	59	86	11,249	3.8	431	11,475	3.9	446	-123	-7
-399 to -200	1	5.0	26	26	12,083	4.0	487	12,694	3.9	493	-259	0
Total or sire avg.	20		2,830	5,267	12,488	3.9	484	12,060	3.9	472	260	8
Averages weighted by the number of daughters of each sire			2,830	5,267	12,164	3.9	471	11,825	3.9	460	255	9
GUERNSEY												
1,000 & Up	1	1.2	251	321	11,867	4.6	540	10,693	4.6	490	1,078	46
800 to 999	2	2.3	75	123	14,319	4.5	640	12,214	4.6	562	892	36
600 to 799	4	4.7	288	451	11,687	4.6	533	10,374	4.6	482	675	28
400 to 599	15	17.4	11,306	21,700	11,286	4.6	521	10,481	4.7	493	473	16
200 to 399	22	25.6	3,856	7,390	10,956	4.6	506	10,434	4.7	486	286	10
0 to 199	23	26.7	4,512	6,798	10,612	4.6	493	10,421	4.6	484	128	5
-199 to -1	8	9.3	1,189	1,666	10,446	4.7	486	10,642	4.7	497	-76	-4
-399 to -200	8	9.3	652	860	9,938	4.7	465	10,571	4.7	493	-320	-11
-599 to -400	3	3.5	135	174	9,070	4.8	437	9,954	4.7	472	-510	-18
Total or sire avg.	86		22,264	39,483	10,837	4.6	501	10,496	4.7	490	200	7
Averages weighted by the number of daughters of each sire			22,264	39,483	10,530	4.6	488	10,342	4.7	484	179	5
HOLSTEIN												
1,000 & Up	36	6.0	30,679	52,626	17,254	3.6	617	15,435	3.6	560	1,252	37
800 to 999	42	7.0	22,146	37,011	16,724	3.6	595	15,515	3.6	561	886	25
600 to 799	83	13.9	41,051	78,814	16,587	3.6	589	15,481	3.6	562	683	16
400 to 599	86	14.4	17,073	30,859	16,416	3.6	588	15,584	3.6	566	503	14
200 to 399	101	16.9	38,951	74,050	16,044	3.6	581	15,568	3.6	568	301	9
0 to 199	95	15.9	32,813	64,170	15,385	3.6	557	15,316	3.6	556	96	3
-199 to -1	69	11.5	18,863	29,510	14,989	3.6	543	15,284	3.6	557	-93	-4
-399 to -200	56	9.3	21,504	34,820	14,556	3.7	532	15,126	3.6	548	-289	-6
-599 to -400	18	3.0	3,016	3,783	14,217	3.7	527	15,214	3.6	554	-498	-10
-799 to -600	5	0.8	1,696	3,800	13,781	3.7	515	14,823	3.6	540	-716	-13
-999 to -800	5	.8	1,266	1,334	13,607	3.6	494	14,943	3.7	548	-910	-36
-1,000 & Below	3	.5	1,355	2,017	13,282	3.9	522	15,003	3.7	550	-1,262	-15
Total or sire avg.	599		230,413	412,794	15,820	3.6	570	15,408	3.6	560	298	8
Averages weighted by the number of daughters of each sire			230,413	412,794	15,478	3.6	557	15,144	3.6	550	318	8

TABLE 1.--Average production of milk and butterfat of daughters of sires in AI service, grouped according to range of Predicted Difference for milk--Continued

Pred. Diff. milk range	Sires	Sires in group	Daughters w/HM	Daughter records	Average Production: Daughters Milk	Daughters Fat %	Daughters Fat Lb.	Herdmates Milk	Herdmates Fat %	Herdmates Fat Lb.	Pred. Diff. Milk	Pred. Diff. Fat
Lb.	No.	%	No.	No.	Lb.	%	Lb.	Lb.	%	Lb.	Lb.	Lb.
JERSEY												
1,000 & Up	1	1.2	68	114	12,146	4.5	549	9,668	4.8	466	1,108	37
800 to 999	1	1.2	271	377	11,758	5.1	602	10,736	5.0	532	882	58
600 to 799	8	9.5	877	1,301	10,970	4.9	540	9,786	5.1	496	693	25
400 to 599	7	8.3	284	438	12,577	5.2	657	11,128	5.2	582	517	26
200 to 399	29	34.5	2,835	5,379	10,341	5.0	514	9,740	5.1	493	287	12
0 to 199	14	16.7	1,128	1,758	9,988	5.1	505	9,748	5.0	490	123	9
-199 to -1	13	15.5	893	1,313	8,992	5.1	459	9,194	5.1	466	-86	-3
-399 to -200	8	9.5	400	578	9,123	5.0	458	9,705	5.0	489	-269	-13
-599 to -400	2	2.4	81	92	9,179	5.3	487	9,950	5.1	503	-418	-6
-999 to -800	1	1.2	61	61	7,630	5.2	398	8,836	5.0	444	-886	-33
Total or sire avg.	84		6,898	11,411	10,183	5.0	513	9,779	5.1	495	193	9
Averages weighted by the number of daughters of each sire			6,898	11,411	9,947	5.0	501	9,647	5.1	488	186	9
BROWN SWISS												
1,000 & Up	3	7.9	404	727	16,654	4.1	688	14,417	4.2	600	1,042	44
800 to 999	1	2.6	426	828	13,192	3.7	493	12,306	4.0	497	834	-3
600 to 799	4	10.5	359	739	15,392	4.1	624	14,059	4.2	584	662	19
400 to 599	8	21.1	687	1,309	14,155	4.0	572	13,187	4.1	537	490	18
200 to 399	10	26.3	679	1,250	13,429	4.0	540	12,785	4.1	523	307	8
0 to 199	3	7.9	131	186	13,109	4.0	523	13,008	4.0	526	87	-1
-199 to -1	4	10.5	158	206	12,394	4.1	502	12,626	4.1	515	-101	-6
-399 to -200	2	5.3	342	449	11,977	4.1	496	12,288	4.1	501	-261	-3
-799 to -600	2	5.3	142	192	11,946	4.2	497	12,934	4.0	520	-677	-14
-999 to -800	1	2.6	26	26	11,122	4.0	449	13,028	4.0	522	-966	-36
Total or sire avg.	38		3,354	5,912	13,687	4.0	553	13,108	4.1	536	279	8
Averages weighted by the number of daughters of each sire			3,354	5,912	13,234	4.0	533	12,853	4.1	523	254	7
MILKING SHORTHORN												
400 to 599	1	12.5	13	21	11,937	3.9	461	10,190	3.8	387	506	22
0 to 199	2	25.0	61	123	10,304	3.7	383	10,032	3.8	379	86	2
-199 to -1	4	50.0	149	305	9,626	3.7	354	9,738	3.7	356	-63	-1
-399 to -200	1	12.5	21	23	9,268	3.6	332	10,040	3.7	369	-377	-17
Total or sire avg.	8		244	472	10,039	3.7	372	9,906	3.7	368	6	1
Averages weighted by the number of daughters of each sire			244	472	9,990	3.7	369	9,881	3.7	366	2	0

TABLE 2.--Average production of milk and butterfat of daughters of sires in AI service, grouped according to range of Predicted Difference for fat

Pred. Diff. fat range	Sires	Sires in group	Daughters w/HM	Daughter records	Average Production						Pred. Diff.	
					Daughters			Herdmates				
					Milk	Fat	Fat	Milk	Fat	Fat	Milk	Fat
Lb.	No.	%	No.	No.	Lb.	%	Lb.	Lb.	%	Lb.	Lb.	Lb.
AYRSHIRE												
30 to 39	2	10.0	52	82	14,212	3.9	552	11,711	4.0	465	1,027	36
20 to 29	1	5.0	41	68	14,023	4.0	558	13,401	3.9	518	470	27
10 to 19	6	30.0	2,082	4,036	11,687	3.9	461	11,465	3.9	447	207	12
0 to 9	7	35.0	388	647	13,022	3.9	502	12,745	3.9	502	218	4
-9 to -1	3	15.0	94	158	11,556	3.8	436	11,698	3.8	450	-64	-6
-19 to -10	1	5.0	173	276	11,382	3.7	423	11,275	3.9	436	87	-10
Total or sire avg.	20		2,830	5,267	12,488	3.9	484	12,060	3.9	472	260	8
Averages weighted by the number of daughters of each sire			2,830	5,267	12,164	3.9	471	11,825	3.9	460	255	9
GUERNSEY												
40 to 49	2	2.3	313	423	12,211	4.5	553	10,768	4.5	489	1,008	44
30 to 39	2	2.3	97	123	12,219	4.9	602	11,220	4.8	536	622	37
20 to 29	13	15.1	4,487	7,090	11,624	4.7	542	10,724	4.7	501	476	23
10 to 19	26	30.2	5,822	10,449	11,091	4.7	519	10,516	4.7	492	252	13
0 to 9	20	23.3	8,415	16,719	10,519	4.6	483	10,297	4.6	478	184	4
-9 to -1	8	9.3	1,258	1,951	10,499	4.6	480	10,611	4.6	492	5	-5
-19 to -10	12	14.0	1,794	2,642	10,081	4.5	458	10,348	4.6	481	-100	-13
-29 to -20	3	3.5	78	86	9,427	4.7	439	10,276	4.7	488	-434	-24
Total or sire avg.	86		22,264	39,483	10,837	4.6	501	10,496	4.7	490	200	7
Averages weighted by the number of daughters of each sire			22,264	39,483	10,530	4.6	488	10,342	4.7	484	179	5
HOLSTEIN												
60 & Up	3	0.5	459	568	20,168	3.8	766	16,596	3.6	604	1,656	69
50 to 59	2	.3	532	1,223	17,202	3.6	623	15,293	3.6	545	1,146	54
40 to 49	18	3.0	26,372	45,837	16,549	3.7	606	15,196	3.6	550	1,120	45
30 to 39	42	7.0	24,471	43,425	16,581	3.7	607	15,421	3.6	560	807	33
20 to 29	78	13.0	26,138	48,750	16,503	3.7	606	15,527	3.6	563	542	25
10 to 19	129	21.5	21,093	36,577	16,374	3.6	593	15,665	3.6	570	440	14
0 to 9	148	24.7	60,672	109,948	15,801	3.6	564	15,469	3.6	561	259	4
-9 to -1	102	17.0	54,776	101,206	15,084	3.6	540	15,226	3.6	554	17	-5
-19 to -10	55	9.2	11,754	19,882	14,564	3.6	518	15,031	3.6	546	-202	-13
-29 to -20	13	2.2	3,531	4,717	14,470	3.5	508	14,934	3.6	545	-251	-24
-39 to -30	7	1.2	507	553	13,373	3.6	483	14,617	3.7	535	-841	-34
-49 to -40	2	.3	108	108	13,707	3.6	495	15,020	3.7	559	-867	-41
Total or sire avg.	599		230,413	412,794	15,820	3.6	570	15,408	3.6	560	298	8
Averages weighted by the number of daughters of each sire			230,413	412,794	15,478	3.6	557	15,144	3.6	550	318	8

TABLE 2.--Average production of milk and butterfat of daughters of sires in AI service, grouped according to range of Predicted Difference for fat--Continued

Pred. Diff. fat range	Sires	Sires in group	Daughters w/HM	Daughter records	Average Production						Pred. Diff.	
					Daughters			Herdmates				
					Milk	Fat	Fat	Milk	Fat	Fat	Milk	Fat
Lb.	No.	%	No.	No.	Lb.	%	Lb.	Lb.	%	Lb.	Lb.	Lb.
JERSEY												
50 to 59	1	1.2	271	377	11,758	5.1	602	10,736	5.0	532	882	58
30 to 39	8	9.5	1,002	1,581	11,225	5.1	575	9,949	5.1	504	591	34
20 to 29	9	10.7	1,449	2,205	11,576	5.2	597	10,491	5.2	545	505	24
10 to 19	24	28.6	2,076	3,956	10,399	5.0	524	9,796	5.1	497	292	14
0 to 9	23	27.4	912	1,603	9,876	5.0	490	9,613	5.0	483	110	4
-9 to -1	9	10.7	442	748	9,186	5.1	466	9,438	5.1	479	-92	-4
-19 to -10	6	7.1	560	736	9,143	4.9	448	9,520	5.0	476	-156	-14
-29 to -20	3	3.6	125	144	9,237	4.9	454	9,868	5.1	502	-287	-23
-39 to -30	1	1.2	61	61	7,630	5.2	398	8,836	5.0	444	-886	-33
Total or sire avg.	84		6,898	11,411	10,183	5.0	513	9,779	5.1	495	193	9
Averages weighted by the number of daughters of each sire			6,898	11,411	9,947	5.0	501	9,647	5.1	488	186	9
BROWN SWISS												
50 to 59	1	2.6	348	651	14,098	4.1	583	13,044	4.1	529	1,041	53
40 to 49	1	2.6	15	24	21,005	4.2	886	16,772	4.3	725	1,062	42
30 to 39	1	2.6	41	52	14,858	4.0	595	13,435	4.1	545	1,022	37
20 to 29	6	15.8	215	418	14,798	4.2	616	13,521	4.2	565	525	23
10 to 19	11	28.9	771	1,650	14,000	4.0	561	13,176	4.0	532	422	14
0 to 9	5	13.2	461	731	13,123	4.0	527	12,746	4.1	520	251	4
-9 to -1	9	23.7	1,264	2,074	12,751	4.0	506	12,666	4.1	516	102	-3
-19 to -10	3	7.9	213	286	11,960	4.1	489	12,684	4.0	513	-505	-16
-39 to -30	1	2.6	26	26	11,122	4.0	449	13,028	4.0	522	-966	-36
Total or sire avg.	38		3,354	5,912	13,687	4.0	553	13,108	4.1	536	279	8
Averages weighted by the number of daughters of each sire			3,354	5,912	13,234	4.0	533	12,853	4.1	523	254	7
MILKING SHORTHORN												
20 to 29	1	12.5	13	21	11,937	3.9	461	10,190	3.8	387	506	22
0 to 9	3	37.5	68	128	9,866	3.7	366	9,791	3.7	362	4	1
-9 to -1	3	37.5	142	300	9,839	3.7	361	9,881	3.7	366	-31	-2
-19 to -10	1	12.5	21	23	9,268	3.6	332	10,040	3.7	369	-377	-17
Total or sire avg.	8		244	472	10,039	3.7	372	9,906	3.7	368	6	1
Averages weighted by the number of daughters of each sire			244	472	9,990	3.7	369	9,881	3.7	366	2	0

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